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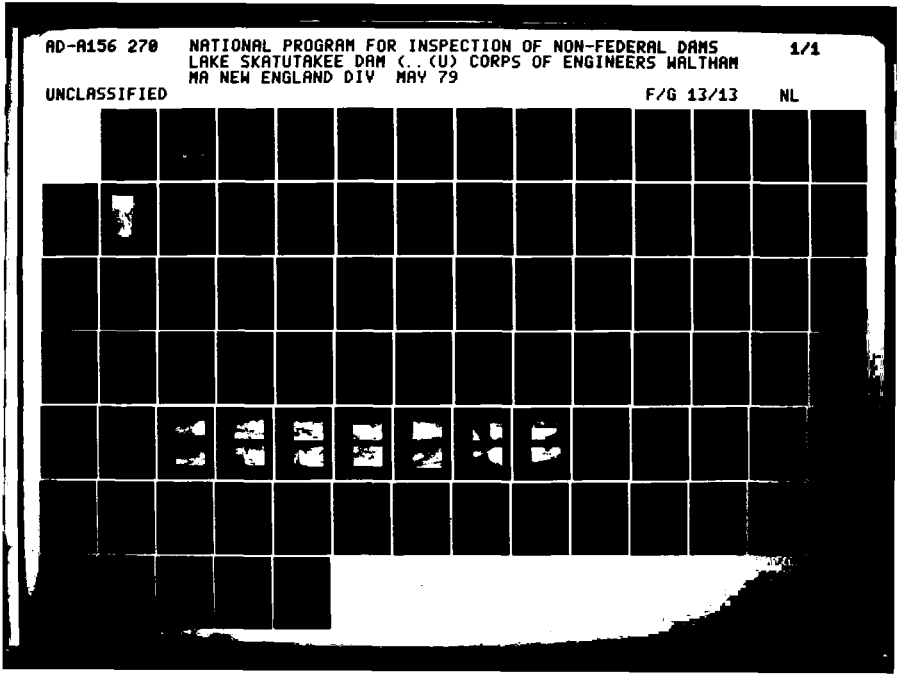

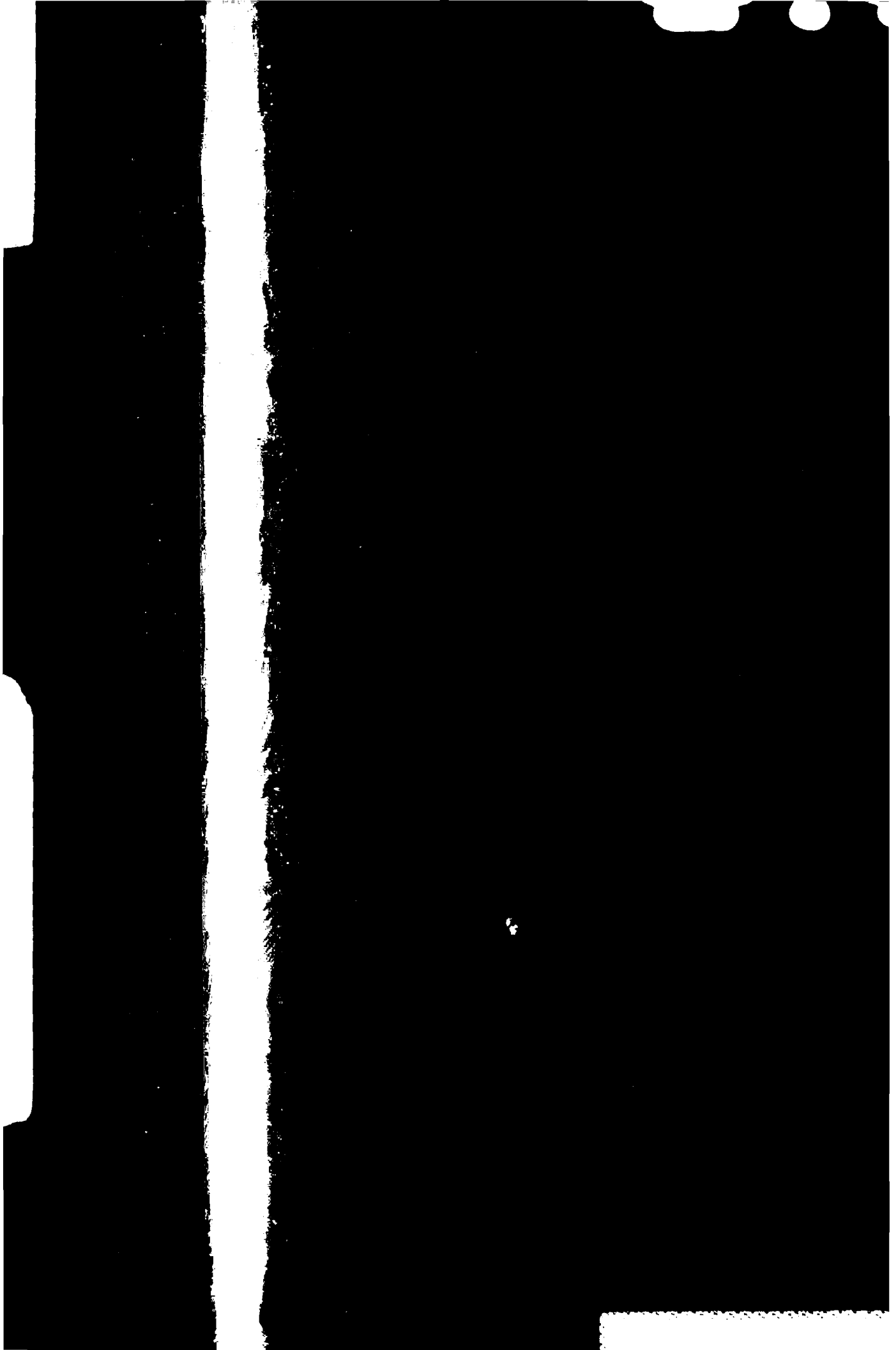

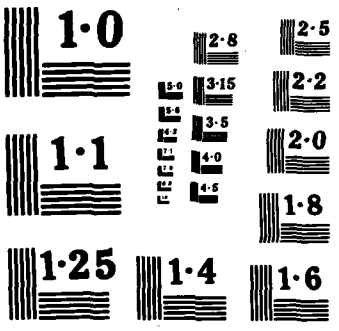

NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

MERRIMACK RIVER BASIN

HARRISVILLE, NEW HAMPSHIRE

LAKE SKATUTAKEE DAM

NH 00066

NHWRB 109.10

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

MAY 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NH 00066	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Lake Skatutakee Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE May 1979 13. NUMBER OF PAGES 75
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Harrisville New Hampshire
Nabanusit Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a dry rubble masonry dam, capped with concrete and with a concrete slab constructed over the upstream face. It has a maximum height of 13 ft. and is about 125 ft. long. TXe dam is judged to be in fair condition. At the time of inspection the gate controlling the flow through the sluice conduit was not operable. The dam fall under the category of high hazard potential and it is intermediate in size.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED-E

AUG 17 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding for your use a copy of the Lake Skatutakee Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment which emphasizes the inadequacy of the project spillway under test flood conditions is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Lake Skatutakee Dam would likely be exceeded by floods greater than 2 percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Screening criteria for initial review of spillway adequacy specifies that this class of dam, having insufficient spillway capacity to discharge fifty (50) percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations there appears to be a serious deficiency in spillway capacity. This could render the dam unsafe in the event of a severe storm which would likely cause overtopping and possible failure of the dam, significantly increasing tne hazard potential for loss of life downstream from the dam.

NEDED-E
Honorable Hugh J. Gallen

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 12 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy preciptiation, round-the-clock surveillance should be provided.

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to Water Resources Board, the cooperating agency for the State of New Hampshire. This report has also been furnished to the owner of the project, Lake Skatutakee Association, P.O. Box 102, Harrisville, New Hampshire 03450.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for the cooperation extended in carrying out this program.

Sincerely yours,

WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

LAKE SKATUTAKEE DAM

NH 00066

NHWRB 109.10

MERRIMACK RIVER BASIN

HARRISVILLE, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	NH 00066
Name of Dam:	Lake Skatutakee Dam
Town:	Harrisville
County & State:	Cheshire, New Hampshire
Stream:	Nubanusit Brook
Date of Inspection:	May 18, and May 26, 1978

BRIEF ASSESSMENT

Lake Skatutakee Dam is a dry rubble masonry dam, capped with concrete and with a concrete slab constructed over the upstream face. The dam has a maximum height of 13 feet and is approximately 125 feet long. The concrete capped spillway is divided into two parts, each 49 feet long, and located on each side of a centrally located sluice gate. The crest of each spillway is 12 inches lower than top of dam.

Based on visual inspection, the dam is judged to be in fair condition. At the time of the inspection the gate controlling the flow through the sluice conduit was not operable. Water was observed seeping out of the west abutment. Continuance of this classification depends on proper operations and maintenance of the dam.

This dam falls under the category of high hazard potential, and it is intermediate in size.

The test flood peak inflow is equal to the Probable Maximum Flood, 21,235 cfs, and the test flood peak outflow is 16,606 cfs. Hydraulic analyses indicate that the maximum surcharge pool elevation is 1213.4, approximately 11.4 feet above the spillway crest. The spillway will pass approximately 2% of the test flood peak outflow without overtopping the dam, and therefore, the spillway capacity is inadequate. The test flood would overtop the dam by 10.4 feet.

As stated in Section 7.2, within 1 year of receipt of this Phase I report the owner, Lake Skatutakee Association, should retain the services of a competent engineer and inplement the results of his evaluation of the following:

1. The modification necessary to improve the hydraulic and hydrologic condition of the dam.

2. Extent of damage in Eastview in the event of failure of the dam.

The following operating and maintenance measures, as stated in Section 7.3, should also be implemented:

1. Existing service gate should be made operational.

2. Leaks through the face of the dam should be monitored until such time it can be repaired.

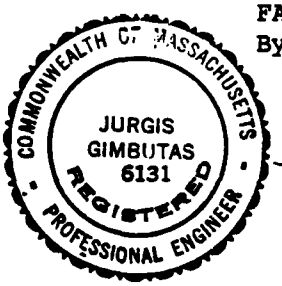
3. All concrete surfaces should be repaired.

4. Upstream slope of dam should be inspected at low water.

5. An operating and maintenance manual for the project be prepared.

6. A program of technical biannual periodic inspection of the project features should be prepared and initiated.

7. Surveillance and a warning system be developed for periods of unusually heavy rains and runoff.



FAY, SPOFFORD & THORNDIKE, INC.
By

Jurgis Gimbutas

Jurgis Gimbutas, P.E.
Project Engineer

Richard W. Albrecht, P.E.
Vice President

This Phase I Inspection Report on Lake Skatutakee Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

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OVERVIEW PHOTOGRAPH

LAKE SKATUTAKEE DAM, LOOKING EAST
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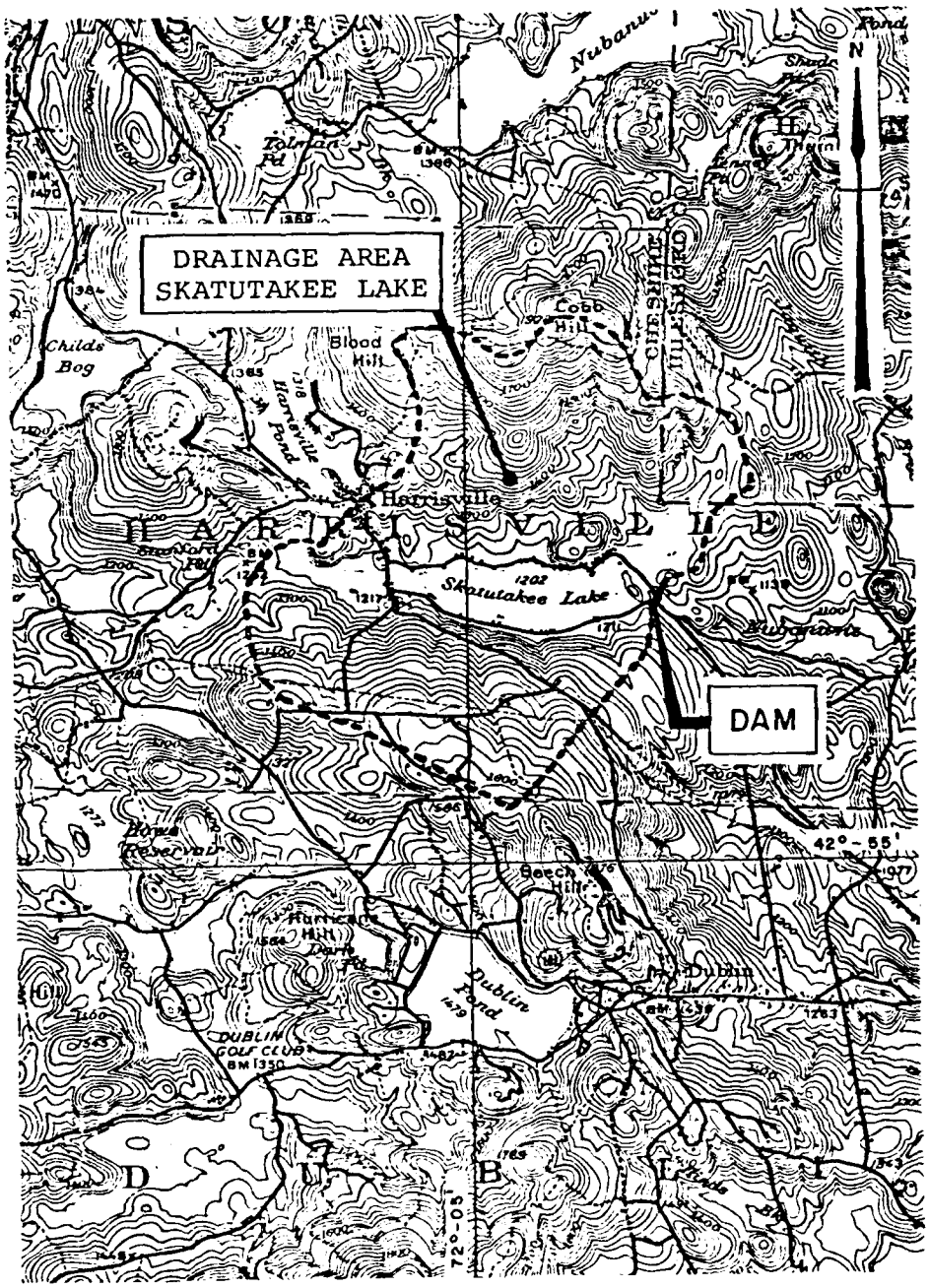

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UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

NEW HAMPSHIRE
MONADNOCK QUADRANGLE
1949
AMS 6569 I-SERIES V 712

LAKE SKATUTAKEE DAM

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Fay, Spofford & Thorndike, Inc., Engineers, have been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed was issued to Fay, Spofford & Thorndike, Inc., under a letter of May 3, 1978, from Mr. Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0308 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Lake Skatutakee Dam is located in the southwestern part of the State of New Hampshire in the Town of Harrisville on Nubanusit Brook, a tributary of Contoocook River, which flows into the Merrimack River. The site is 1 1/2 miles upstream from the village of Eastview and 11 miles east of Keene, New Hampshire.

Lake Skatutakee discharges through a rock channel into the Lower Pond. This pond has been created on the left side of Hancock Road by constructing Lake Skatutakee Dam.

b. Description of Dam

The dam consists of dry rubble masonry capped with concrete with a length of approximately 125 feet and a maximum height of 13 feet above the stream bed. The spillway crest is approximately 2 feet in width with a vertical downstream face and an upstream face inclined at about 45 degrees. Field observation indicates that a concrete slab has been constructed over the upstream face.

The concrete capped spillway is divided into two parts, each 49 feet long, and located on each side of a centrally located sluice gate. The crest of each spillway has a freeboard of 12 inches. The outlet consists of a gate controlled sluice conduit approximately 4 feet by 4.5 feet with the sill located approximately 9 feet below the spillway crest. According to Mr. Edward Rogers, President of the Lake Skatutakee Association, this gate has not been operable for approximately 8 years (Photograph No. 3, Appendix C).

c. Size Classification

The storage capacity at the spillway crest is 1,680 acre-feet which falls in the range $\geq$ 1,000 and $<$ 50,000 acre-feet; therefore, the dam is classified as intermediate in size.

d. Hazard Classification

In the event of failure of this dam, Eastview Village, which is at a distance of approximately 1 1/2 miles downstream of the dam, will be in danger of being flooded. It is estimated that in the event of failure of this dam, loss of more than a few lives and excessive property damage might be threatened. Therefore, this dam falls in the category of high hazard potential.

e. Ownership

Prior to 1930, the owner was the White Mills of New Hampshire. Prior to 1937, the local name of this dam was Harrisville Pond Dam.

In 1954, the owners were the Verney Mills of West Peterborough. In 1958, the flowage rights at Lake Skatutakee were acquired by Messrs. B. Harold Erskine and Walter J. Ransburg, of the former Peterborough Mills. They also had the duty of maintaining the dam.

On October 1, 1970, this dam and the water rights were transferred to Lake Skatutakee Association. The next year, it was proposed that the Water Resources Board of New Hampshire acquire water rights and the dam; but the House Bill No. 460, introduced by Representative Trowbridge of Cheshire District 4, was not passed. Consequently, the dam is still owned by the Lake Skatutakee Association, whose current president is Mr. Edward Rogers.

f. Operator

Mr. Edward Rogers, Lake Skatutakee Association, P.O. Box 102, Harrisville, New Hampshire 03450, telephone 603-827-3491.

g. Purpose of Dam

Since its construction in the 19th century, this dam and the reservoir were utilized to store water for power used by mills downstream . Currently, Lake Skatutakee, surrounded by 73 cottages (1962), is a recreational reservoir. Property owners have expressed concern regarding the maintenance of a minimum water level.

h. Design and Construction History

The earliest date of construction of a dam at this site appears to have been in 1823. A deed by Mr Alexander Ernes to Phoenix Cotton and Paper Factory, granted in 1823, (Volume 93, page 374), permitted the factory "to build, raise and maintain forever a dam across such outlet" at the east end of the North Pond in Dublin. This information was supplied to the Lake Skatutakee Committee by Mr. John R. Goudnow, an attorney in Keene, New Hampshire. In his letter, dated September 22, 1961, Mr. Goodnow assumed that "since 1823, there have undoubtedly been various changes in the height of the dam as well as in the depth of the channel of the outlet."

A brief inspection of the memorandum of June 24, 1930, stated that "this is a timber and stone dam, and gates are O.K."

In 1937, the dam was capped with a 2-foot wide concrete crest, and a concrete slab was placed on the old masonry upstream slope. A centrally located sluice gate was renovated, presumably at the same time. Concrete abutments were constructed 12 inches higher than the spillways. As there are no construction plans available, all information about the improvements done in 1937 was taken from an unsigned sketch dated October 8, 1937.

i. Normal Operational Procedure

Since the gate controlled sluice conduit is inoperable, there is no control of the flow over the spillway, and the water level in the lake cannot be lowered.

In 1968, the dam was in need of repairs due to deterioration. These repairs were described as "minor in nature and the structural stability of the dam is not in danger" (letter dated June 21, 1968, signed by Mr. Vernon A Knowlton, Water Resources Engineer). On March 15, 1971, Mr. Francis C. Moore, P.E., Water Resources Engineer, recommended the following alterations be made:

(1) raising of abutments by 2 feet;

(2) installation of a stop log sluiceway at one end of the dam;

(3) repair of existing gate and any other needed repairs and channeling.

The cost of this work was estimated to be approximately $30,000. At that time, a cubic yard of reinforced concrete in place was estimated to cost $200. There is no evidence that any of these repairs were made. Inspections in 1974 and 1977, revealed that the dam has not been altered since 1937 or possibly earlier.

1.3 Pertinent Data

a. Drainage Area

Skatutakee Lake as shown on the U.S.G.S. Quadrangle Sheet is located on Nubanusit Brook. It has a total drainage area of 13.7 square miles. The watershed is highly wooded, undulated and rolling.

b. Discharge at Dam Site

(1) Outlet works (sluice conduit) - size 4 feet by 4.5 feet at Invert Elevation 1193 (Photograph No. 4, Appendix C). Estimated discharge capacities of this conduit are given below:

372 cfs at test flood Maximum Pool Elevation 1213.4
244 cfs at top of dam Elevation 1203.0
228 cfs at spillway crest Elevation 1202

(2) Maximum known flood at dam site - Flood of September 21-24, 1938. Magnitude not recorded.

(3) Ungated spillway capacity at top of dam is 294 cfs at Elevation 1203.0.

(4) Ungated spillway capacity at test flood is 11,316 cfs at maximum pool Elevation 1213.4.

c. Elevation (Feet above MSL)

(1) Top dam - 1203.

(2) Test flood maximum pool level - 1213.4. This valve is obtained by approximate routing of spillway test flood peak inflow. Refer to Appendix D.

(3) Full flood control pool - 1203. In the absence of pertinent data, it is assumed that full flood control elevation coincides with the top of dam.

(4) Recreation pool - 1202. It is assumed that the recreation pool elevation is the same as the spillway crest elevation.

(5) Spillway crest (ungated) - 1202.

(6) Stream bed at centerline of dam - 1189.

(7) Maximum tailwater - 1191 (estimated).

d. Reservoir

(1) Length of maximum pool - 1.6 miles (estimated).

(2) Length of recreation pool - less than 1.6 miles (estimated).

(3) Length of flood control pool - 1.6 miles (estimated).

e. Storage (Acre-Feet) - The following values are estimated:

(1) Top of dam - 1950 acre-feet.

(2) Test flood maximum pool elevation - 4758 acre-feet.

(3) Flood control pool - 1950 acre-feet.

(4) Recreation pool - 1680 acre-feet.

(5) Spillway crest - 1680 acre-feet.

f. Reservoir Surface (Acres)

(1) Top of dam - 270 acres (estimated).

(2) Maximum test flood pool level - 345 acres (estimated).

(3) Flood control pool - 270 acres (estimated).

(4) Recreation pool - 261 acres (estimated).

(5) Spillway crest - 261 acres.

g. Dam

(1)	Type	Dry rubble masonry
(2)	Length	125 feet
(3)	Height	13 feet
(4)	Top width	2 feet
(5)	Side slopes	
	(a) Upstream	Approximately 1 vertical to 1 horizontal
	(b) Downstream	Vertical
(6)	Zoning	Not applicable
(7)	Impervious core	Not applicable
(8)	Cutoff	Concrete facing on upstream side prevents water seepage through the dam

h. Spillway

(1)	Type	Ungated concrete weir
(2)	Length of weir	Two sections, 49 feet each, total length 98 feet
(3)	Crest elevation	1202
(4)	Gates	None

(5)	U/S Channel	Pond

i. Regulating Outlets

(1)	Invert	1193
(2)	Size	Width 4.5 feet; depth 4 feet; length and width of dam 9 feet below crest of spillway
(3)	Description	Concrete sluice conduit
(4)	Control mechanism	Gate control, manually operated (presently non-operable)

SECTION 2 - ENGINEERING DATA

2.1 Design

No original design data was disclosed for Lake Skatutakee Dam.

2.2 Construction

No engineering data are available on the construction of this dam.

2.3 Operation

Except for sketchy information, past flood details are not available for this dam; but rainfall records for the area are available for the years 1892 to 1941. It is noted that significant monthly rainfalls were recorded in March, 1938 and September, 1936. Rainfall recorded in the month of September, 1938 was 12.43 inches, which was more than 3.5 times the monthly average rainfall. The flood of September 21-24, 1938, is considered to be the maximum flood that has occurred in the area. On the basis of regional frequency studies, the flood of 1938 corresponds to a 100-year flood.

On October 11, 1938 a questionnaire issued by the Water Control Commission in Concord, New Hampshire, revealed that this dam was not damaged by the flood of September, 1938. The maximum height of water over the permanent crest of the spillway was not measured because the person entrusted with the responsibility of taking the measurement could not get to the dam.

After this flood, the channel between Skatutakee Lake and the Lower Pond to the east side of Hancock Road was blasted and deepened in order to allow more flow of water through the channel. This information was obtained from a letter dated May 12, 1954, to W. White, Chairman, New Hampshire Water Resources Board.

Records of operation of this dam and of performance observations are not available.

History of previous failures or deficiencies and pending remedial measures for correcting known deficiencies and the schedule for accomplishing remedial measures are not known, except that seepage through the downstream face of right abutment has not been remedied.

2.4 Evaluation

a. Availability

Except for sketchy data mentioned elsewhere in this report, pertinent geotechnical and hydrologic and hydraulic data, which formed the basis of the design of the dam, are not available from the project records. However, structural data is available on a limited basis.

b. Adequacy

Sufficient engineering data are availale for a Phase I inspection.

c. Validity

The available engineering data is considered valid on the basis of the results of the visual inspection.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

The Phase I inspection of the dam at Lake Skatutakee was performed on May 18, and May 26, 1978. A copy of the inspection check list is included in Appendix A.

a. General

In general, the soil and rock features are in fair condition. The concrete was observed to be in poor condition, see subparagraph c.

b. Dam

No evidence of vertical or horizontal misalignment was observed. There is no indication of sloughing, bulging or movement of the slopes, nor is there any evidence of piping.

Field measurement indicates that the right aboutment, roadway side, is approximately 14.5 feet long with a maximum height of about 8.5 feet. Water was observed seeping out of this abutment, and the rate increased as the height of the dam increased. The discharge water was clear and it is estimated to be less than 1/2 cfs. Available records indicate that this seepage was first observed in 1977 and probably existed a number of years prior to this date.

The upstream face of the dam could not be observed during the inspection due to the fact that water was flowing over the spillway. Observation, from the top of the spillway indicates that the upstream face is inclined at about 45 degrees.

c. Appurtenant Structures

At the time of the inspection, the gate controlling the flow through the sluice conduit was not operable. It was learned that the gate had not been in operation for approximately 8 years.

The top of the gate structure shows severe spalling and cracking of the concrete, especially on the downstream side (Photograph No. 3, Appendix C).

The crest of the spillway and both abutments are in fair condition. Several vertical cracks and some spalling was observed in the concrete cap of the dam. At the left abutment, grass was growing in a crack approximately 6 feet from the roadway.

The exposed faces of the rubble masonry wall appear to be sound. Vertical cracks were observed in the concrete slab on the upstream face.

d. Reservoir Area

Lake Skatutakee is at the lower end of Nubanusit Brook between Harrisville Village and Bonds Corner. There are three conservation reservoirs draining into Lake Skatutakee, including Spoonwood Lake, Nubanusit Lake and Harrisville Pond.

Lake Skatutakee has a pond area of 261 acres, a length of 1.6 miles, a minimum width of 1/3 mile and a shoreline of 3.8 miles. There are about 73 cottages scattered around Skatutakee Lake. The shoreline of Skatutakee Lake is heavily wooded and the lake area is rocky.

e. Downstream Channel

The downstream channel and side slopes are in good condition.

The concrete capped spillway is divided into two parts each 49 feet long. Field observations indicate that the bottoms of the channel immediately below the western spillway varies from approximately 8 to 13 feet below the crest of the dam and the eastern spillway aproximately 4 feet. All indications are that this channel was constructed in this manner (Photographs No. 2, 5 and 6, Appendix C).

Debris was observed in this channel with bushes overhanging. The quantity of debris is small and will not impede the flow in the channel (Photographs No. 7, 8 and 10, Appendix C).

f. Channel Between Lake Skatutakee and Lower Pond

The discharge from Lake Skatutakee was observed to flow through a rock channel into the Lower Pond. This pond was created by constructing Lake Skatutakee Dam. This channel was widened and deepened by blasting sometime between 1919 and 1921, and again in 1938, according to available records. A reinforced concrete bridge was constructed across the outlet channel to accommodate local traffic.

This act of deepening and widening the channel would naturally permit more flow from Skatutakee Lake into Lower Pond and eventually would result in the lowering of the water surface level in Skatutakee Lake only in the absence of the dam. During high flows, the water surface level in Skatutakee Lake is controlled by the spillway of the dam, unaffected by the artificial outlet channel (Photographs No. 13 and 14, Appendix C).

3.2 Evaluation

The observed condition of the dam is fair. The potential problems observed during the visual inspection are:

1. Leaks through the face of the west abutment.
2. Potential for overtopping.
3. Inability to drain the pond because of the inoperable slu gate.
4. Concrete corosion.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

Lake Skatutakee Association has operated Lake Skatutakee Dam since 1970. The pond level is maintained by an ungated spillway of 98 feet in length. The pond level can not be lowered due to the inoperable sluice gate.

4.2 Maintenance of Dam

The maintenance of Skatutakee Lake Dam is the responsibility of the Lake Skatutakee Association.

4.3 Maintenance of Operating Facilities

No written maintenance procedures were disclosed for Lake Skatutakee Dam. Maintenance of the gate operating facilities controlling the opening of the undersluice in the middle of the spillway is non-existent. Consequently, the gate is inoperable.

4.4 Description of any Warning System in Effect

A flood warning system is non-existent.

4.5 Evaluation

The current operation and maintenance procedure for Lake Skatutakee Dam are inadequate to ensure that all problems can be remedied within a reasonable period of time.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

(1) This dam falls under the category of high hazard potential and it is intermediate in size. Using the "Recommended Guidelines for Safety Inspection of Dams", the recommended spillway test flood peak inflow is equal to the Probable Maximum Flood. The spillway test flood inflow hydrograph, estimated, is furnished in Appendix D. The spillway test flood peak inflow is 21,235 cfs.

(2) The estimated maximum peak outflow corresponding to the spillway test flood is 16,606 cfs. Refer to Appendix D for details.

(3) Lake storage capacity versus elevation - an estimated capacity curve is included in Appendix D.

(4) Estimated discharge rating curve for the spillway is furnished in Appendix D.

(5) Composite discharge rating curve for pool levels above the top of dam (assuming dam remains intact) is furnished in Appendix D.

(6) Hydrologic map of the watershed above the dam site, including reservoir area, is included in Appendix D.

b. Experience Data

No records on previous floods and their magnitude at the dam site are available. For operational experience refer to Section 1.1.i.

c. Visual Observations

The crest of the non-overflow section is 1 foot above the crest of the spillway. At the time of inspection, water was flowing over the spillway at a depth of 2 inches. The hydraulic design of the spillway is very poor, and there are no energy dissipation works below the dam. Water is allowed to fall freely on the channel bed downstream of the spillway. The stream bed is lined with boulders in a random, pattern.

d. Overtopping Potential

The spillway test flood peak inflow for Lake Skatutakee Dam in view of its size and hazard category is 21,235 cfs, and the test flood peak outflow is 16,606 cfs. Assuming the dam remains intact after being overtopped, the estimated surcharge height above the crest of the spillway is about 11.4 feet; and the corresponding maximum pool elevation would be 1213.4. The spillway will pass only 2% of the test flood peak outflow without overtopping the dam, and therefore, the spillway capacity is inadequate. The test flood would overtop the dam by 10.4 feet. Refer to Appendix D for further particulars.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The upstream slope could not be seen due to the fact that it was under water. The slopes do not show any erosion or weak areas. The only evidence of possible stability problems revealed by the visual inspection are the leaks through the face of the west abutment.

b. Design and Construction Data

There are no design computations or drawings available. Only free-hand sketches made in 1937, after the reconstruction of the dam, are available.

c. Operating Records

Except memorandums and correspondence, listed in Appendix B, other records are not available.

d. Post-Construction Changes

Presumably, the last improvements were done in 1937. No later changes were noted.

e. Seismic Stability

The dam is located in Seismic Zone 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The visual inspection and operational history indicates that this dam is in fair condition and functioning unsatisfactorily.

b. Adequacy of Information

An adequate assessment of the dam consistent with the scope of a Phase I investigation has been made based upon the visual inspection and avaialable information.

c. Urgency

The recommendations and remedial measures enumerated in Sections 7.2 and 7.3 should be implemented within 1 year of receipt of this Phase I report.

d. Need for Additional Investigation

The information available from the visual inspection is adequate to identify the potential problem of overtopping. This problem will require the attention of a competent engineer who will have to make additional engineering studies to design or specify remedial measures to rectify the problem.

7.2 Recommendations

It is recommended that the Lake Skatutakee Association retain the services of a competent engineer to perform a study to improve the hydraulic and hydrologic condition of the Dam. As a general guide, the study should include the raising of the abutment and the installation of a sluiceway at one end of the dam. Due to the inadequate spillway capacity, it should also include the extent of damage in the village of Eastview in the event of failure of the dam.

7.3 Remedial Measures

It is considered important that the following operating and maintenance procedures be attended to as early as practical:

a. The existing sluice gate should be made operable and access to it from the right abutment should be made safe and easy.

b. Leaks through the face of the west abutment should be monitored regularly until such time as they can be repaired.

c. All concrete surfaces should be repaired as continued deterioration could develop into a serious problem.

d. Upstream slope of dam should be inspected at low water.

e. An operating and maintenance manual for the project should be prepared.

f. A program of technical biannual periodic inspection of the project features should be prepared and initiated.

g. Because the location of the dam is upstream of a populated area and items of concern with respect to the design of the dam, round-the-clock surveillance should be provided during periods of high precipitation.

h. The owner should develop a formal warning system. An operational procedure to follow in event of an emergency should also be adopted.

7.4 Alternatives

Until the hydraulic and hydrologic condition of this dam is improved, the pond should be operated at a lower level to provide more storage during extreme flood events and spring runoff.

APPENDIX A

VISUAL INSPECTION CHECK LISTS

APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Lake Skatutakee Dam

DATE May 18, & 26, 1978

TIME May 18, - 1300-1500
May 26, - 900-1330

WEATHER May 18, - Rain
May 26, - Sunny

W.S. ELEV. 1202.2 U.S. _____ DN.S. 2" above spillway

PARTY:

1. Jurgis Gimbutas, P.E.	Team Captain - Structural and Concrete
2. Harvey H. Stoller, P.E.	Soils, Geology and Foundations
3. V. Rao Maddineni, P.E.	Hydraulics and Hydrology

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Dam Embankment	H. H. Stoller	Fair
2. Outlet Works	J. Gimbutas	Fair
3. Spillway Weir	J. Gimbutas	Good
4. Approach & Discharge Channels	V. Rao Maddineni H. H. Stoller	Good
5. Lake and Downstream Channel	V. Rao Maddineni	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Skatutakee Dam DATE May 18, & May 26, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils & Foundations NAME [signature]

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	1203
Current Pool Elevation	1202.2
Maximum Impoundment to Date	Unknown
Surface Cracks	Minor cracks in concrete cap (see narrative)
Pavement Condition	None
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	No visual vertical misalignment observed
Horizontal Alignment	No visual horizontal misalignment observed
Condition at Abutment and at Concrete Structures	Normal

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Skatutakee Dam DATE May 18, & May 26, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils & Foundations NAME [signature]

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
Indications of Movement of Structural Items on Slopes	No structural items on slope
Trespassing on Slopes	None observed
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or Near Toes	None observed
Unusual Embankment or Downstream Seepage	Seepage at the left abutment (see narrative)
Piping or Boils	None observed
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Skatutakee Dam DATE May 18, & May 26, 1978

PROJECT FEATURE Outlet Works

DISCIPLINE Structures & Concrete NAME [illegible]

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS	
a. Concrete and Structural	
General Condition	Fair condition
Condition of Joints	None observed
Spalling	Minor spalling in capping
Visible Reinforcing	None observed
Rusting or Staining of Concrete	None observed
Any Seepage or Efflorescence	None observed
Joint Alignment	None observed
Unusual Seepage or Leaks in Gate Chamber	Minor seepage
Cracks	Minor cracks in the gate chamber
Rusting or Corrosion of Steel	None observed

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Skatutakee Dam DATE May 18, & May 26, 1978

PROJECT FEATURE Outlet Works

DISCIPLINE Structures & Concrete NAME [illegible]

PROJECT FEATURE

DISCIPLINE NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
b. Mechanical and Electrical	
Service Gates	Not operable for approximately 8 years (verbal information)
Emergency Gates	None
Lightning Protection System	None
Emergency Power System	None
Wiring and Lighting System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Skatutakee Dam DATE May 18, & May 26, 1978

PROJECT FEATURE Spillway Weir

DISCIPLINE Structures & Concrete NAME [illegible]

PROJECT FEATURE Approach Channel

DISCIPLINE Soils & Foundations NAME [illegible]

DISCIPLINE Hydraulics & Hydrology NAME [illegible]

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good condition
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Approach Channel	Could not be seen
b. Weir and Training Walls	
General Condition of Concrete	Fair, some cracks were seen through the water flowing over the crest
Rust or Staining	None observed
Spalling	None observed

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Skatutakee Dam DATE May 18, & May 26, 197

PROJECT FEATURE Spillway Weir

DISCIPLINE Structures & Concrete NAME [illegible]

PROJECT FEATURE Discharge Channel

DISCIPLINE Soils & Foundations NAME [illegible]

DISCIPLINE Hydraulics & Hydrology NAME [illegible]

AREA EVALUATED	CONDITION
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	None observed
Drain Holes	None observed
c. Discharge Channel	
General Condition	Good condition
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Small bushes in places
Floor of Channel	Good condition
Other Obstructions	None observed

APPENDIX B

EXISTING AVAILABLE INFORMATION

APPENDIX B

1. Listing of Design, Construction and Maintenance Records

In the files of New Hampshire Water Resources Board in Concord, New Hampshire, there is one folder, numbered 109.10. It contains these documents of significance, not counting the previous inspection reports:

(1) October 11, 1938. Questionnaire by the New Hampshire Water Control Commission regarding the flood of September 21 and 24 of that year. The dam was not injured.

(2) October 21, 1949. Lake Skatutakee plan with soundings of depth, done by Messrs. T. Frost and J. Richards. Scale: 1" = 651'. Size: 13 inches by 20 inches.

(3) May to August 1954 and later in 1962. Several letters regarding maintenance of a reasonable level of water during the summer months.

(4) September 22, 1961. A letter from Mr. John R. Goodnors, Attorney at Law, to Mr. Beland Pierce, Secretary of Lake Skatutakee Association, examining the records at the Registry of Deeds from 1823, and discussing the rights of the Water Resources Board.

(5) May 22, and 29, 1962. Letters from the Lake Skatutakee Association to the New Hampshire Water Resources Board, seeking an agreement on a minimum water level on the lake and discussing the old channel connecting the Lake Skatutakee and the Lower Pond (location of the dam).

(6) June 1968. Exchange of letters between Mr. Howard B. Lane, Attorney at Law, representing the owner, and the Public Utilities Commission. It concerns the need to re- pair the dam at the outlet of Lake Skatutakee and the reg- ulations regarding the lowering the level of the lake.

(7) March 15, 1971. Memorandum on recommended repairs and improvements to the dam, written by Mr. Francis C. Moore, P.E., Water Resources Engineer. It includes an estimate of construction costs, totaling $30,000.

(8) 1971 - House Bill No. 460. An act by the Senate and House of Representatives of the State of New Hampshire proposing to transfer the dam to the Water Resources Board. The bill was never passed.

2. Copies of Past Inspection Reports

Included with this report are:

(1) June 24, 1930. Unsigned, one-half page.

(2) October 8, 1937, by the New Hampshire Water Resources Board. Two pages including sketches with some dimensions of the dam.

(3) December 12, 1938, by the New Hampshire Water Control Commission, signed by AAN&RLT, one page.

(4) March 12, 1976. Letter, signed by Mr. George M. McGee, Sr., Chairman of the New Hampshire Water Resources Board, indicates that Dam No. 109.10 was inspected on October 18, 1974.

(5) July 22, 1977, by the New Hampshire Water Resources Board, three pages, including sketches with some dimensions of dam.

Harrisville (Cheshire) Inspected June 24, 1930.
Page 3 #10

White Mills of New Hampshire

This is a timber and stone dam capped with concrete apron. Gates O. K. 115 feet wide, mostly spillway. Used principally for control on the lower dams. Dam in good condition.

DIVI-41

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN Merrimack NO. 10 109.10

RIVER Skatutakee Lake MILES FROM MOUTH ____ D.A.SQ.MI -

TOWN Harrisville OWNER [illegible] Mills of N.H.

LOCAL NAME OF DAM (Formerly Harrisville Pond)

BUILT 1825 DESCRIPTION Timber & Stone [illegible] (Concrete [illegible])

[illegible]

POND AREA-ACRES 280.95 DRAWDOWN FT. 9' POND CAPACITY-ACRE FT. ____

HEIGHT-TOP TO BED OF STREAM-FT. 12 14 MAX. ____ MIN. ____

OVERALL LENGTH OF DAM-FT. 145 MAX. FLOOD HEIGHT ABOVE CREST-FT. ____

PERMANENT CREST ELEV.U.S.G.S. ____ LOCAL GAGE ____

TAILWATER ELEV.U.S.G.S. ____ LOCAL GAGE ____

SPILLWAY LENGTHS-FT. 145 98 FREEBOARD-FT. 10'

FLASHBOARDS-TYPE, HEIGHT ABOVE CREST ____

WASTE GATES-NO.	WIDTH	MAX. OPENING	DEPTH SILL BELOW CREST
1	4'	4	9

REMARKS Condition Good

3 T [illegible]

[illegible] 156.7 mi. from [illegible]

Co-ordinates from AE
420 55' + 2900 yds
720 00' + 5900 yds.

POWER DEVELOPMENT

UNITS NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE

USE Storage

REMARKS [illegible] C 224,202

Shown by J. H. Brouner, Supt. Mills, 10/12/37

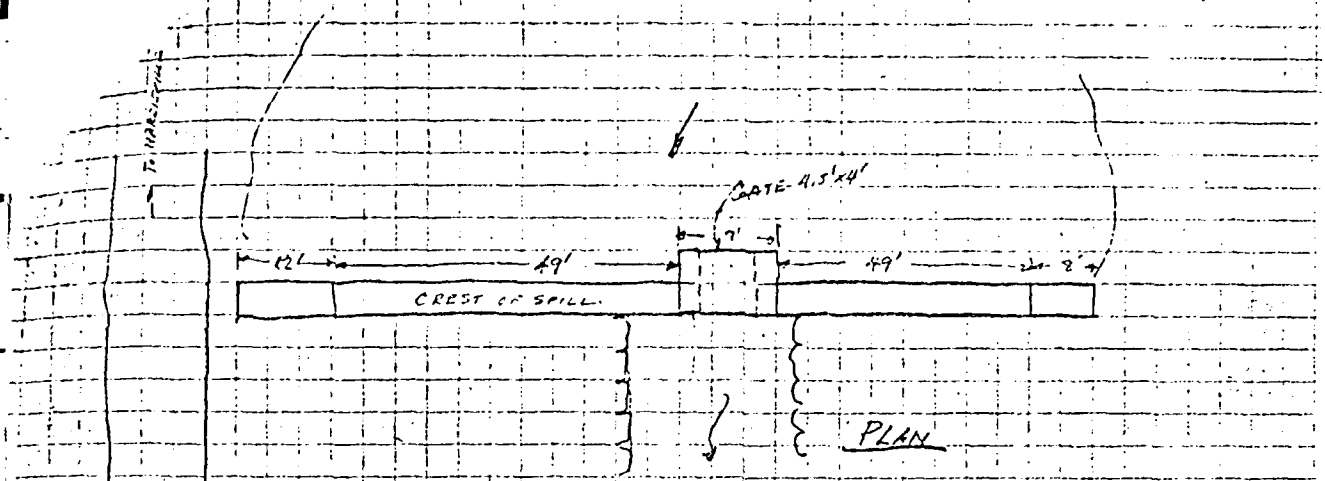
10/26/36 AE

DATE 1925 P.S.

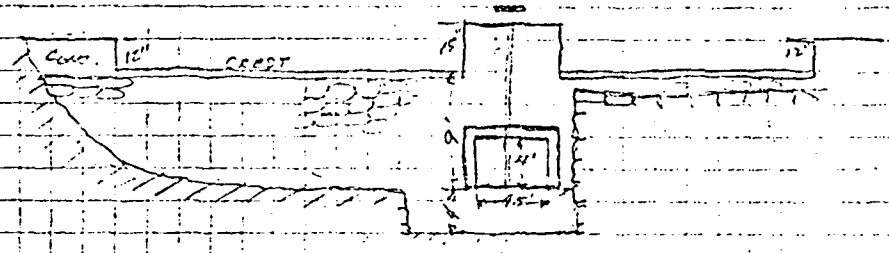
10/8/37 [illegible] J.N.S.

SKATUTAKEE LAKE OUTLET DAM – HARRISVILLE 12/3/37

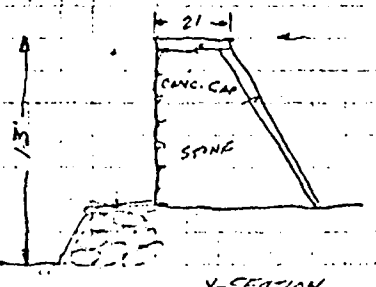
109.10



PLAN



PROFILE



X-SECTION

NEW HAMPSHIRE WATER CONTROL COMMISSION

DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 109.10

Town Harrisville : County Cheshire

Stream Skatutakee Lake

Basin-Primary Merrimack R. : Secondary Nubanusit Bk

Local Name

Coordinates—Lat. 42° 55' + 8,100 : Long. 72° 00' — 17,100

GENERAL DATA

Drainage area: Controlled Sq. Mi.: Uncontrolled Sq. Mi.: Total 12 ± Sq. Mi.

Overall length of dam 125 ft.: Date of Construction

Height: Stream bed to highest elev. 14 ft.: Max. Structure 13.0' ft.

Cost—Dam : Reservoir

DESCRIPTION Stone Concrete Cap & Gate Masonery Dam

Waste Gates

Type

Number 1 : Size 4 ft. high x 4 ½' ft. wide

Elevation Invert 9' : Total Area 18' sq. ft.

Hoist

Waste Gates Conduit

Number : Materials

Size ft.: Length ft.: Area sq. ft.

Embankment

Type

Height—Max. ft.: Min. ft.

Top—Width : Elev. ft.

Slopes—Upstream on : Downstream on

Length—Right of Spillway : Left of Spillway

Spillway

Materials of Construction Masonery

Length—Total ft.: Net 98 ft.

Height of permanent section—Max. 13.0 ft.: Min. ft.

Flashboards—Type : Height 1.0 ft.

Elevation—Permanent Crest : Top of Flashboard

Flood Capacity 245 cfs.: cfs/sq. mi.

Abutments

Materials:

Freeboard: Max. 1.0 ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER White Mills of N H

REMARKS Use— Storage Condition Good

Tabulation By A A N & R L T Date December 12, 1938.

B4B21284

State of New Hampshire

WATER RESOURCES BOARD

37 Pleasant St.
Concord 03301

March 12, 1976

Lake Sketutahkee Association
Harrisville
New Hampshire

Gentlemen

Under the provisions of RSA-Chapter 482, Sections 8 through 15, the New Hampshire Water Resources Board is authorized to inspect all dams in the state which by reason of their physical condition, height, and location may be a menace to the public safety.

The dam structure (Dam # 109.10) located on your property in Harrisville , N.H. was inspected on 10/13/74 and as a result of this inspection no discrepancies were found at the time of the inspection which would require any corrective measures.

This letter is provided for your information only. If you have any questions, please feel free to call or write.

Sincerely,

George M. McGee, Sr.
Chairman

GMM/SCB:L

cc: Board of Selectmen
Harrisville

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: Harrisville Dam Number: 109.10

Name of Dam, Stream and/or Water Body: Lower Scottons

Owner: Lower Scottons Association Telephone Number:

Mailing Address: Harrisville

Max. Height of Dam: 13' → TO BOTTOM OF APRON OF STILLING WELL Pond Area: 2.0 I Length of Dam: 210

FOUNDATION: Ledge, stone & earth

OUTLET WORKS: Spillway w/ waste gate @ center

Dam is laid-up stone w/ 6" concrete cap

Vertical downstream wall

ABUTMENTS: 1½' thick concrete cap on stonework

EMBANKMENT: Laid-up stone w/ vertical downstream wall

Note: Give Sizing, Condition and detailed description for each item, if applicable.

SPILLWAY: Length: 49 + 49 Freeboard: 1'

SEEPAGE: Location, estimated quantity, etc.

RT SIDE EMBANKMENT - SEEPING UP TO 10 GPM

Changes Since Construction or Last Inspection:

Tail Water Conditions:

ROCKLAND STREAM CHANNEL

Overall Condition of Dam: FAIR TO GOOD

Contact With Owner: NO

Date of Inspection: 22 July 1977 Suggested Reinspection Date 1982

Class of Dam: MINOR

Signature [signature]

Date 22 July 1977

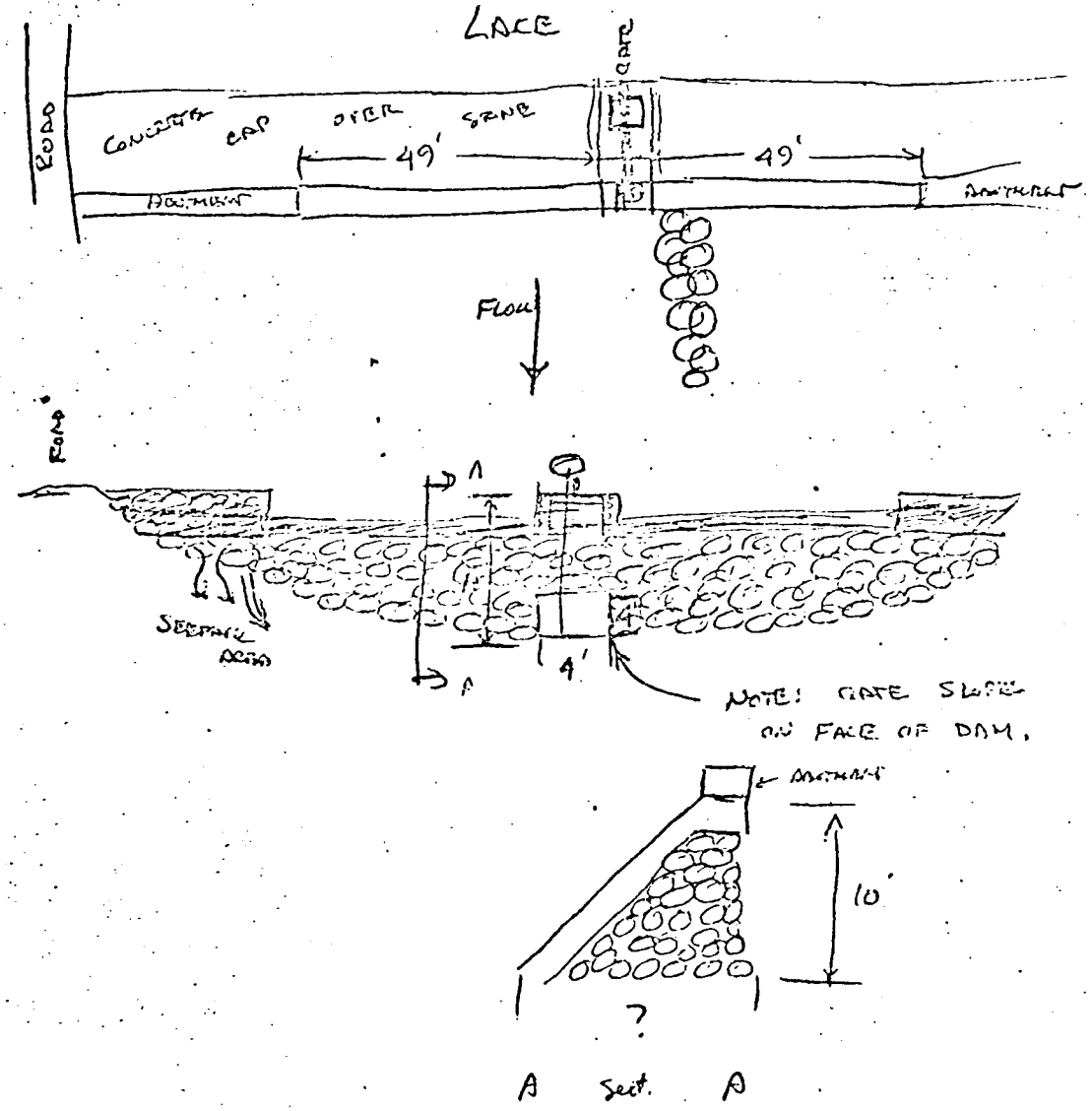
Dam No.

COMMENTS: 1) DEPTH OF FLOW 0.05' OVER SPILLWAY CREST

2) SEVERE UNDERCUTTING ALONG RIPRAP

Dam No._____

SKETCH OF DAM (Show Plan, Elevation & Cross Sections)



A Sect. A

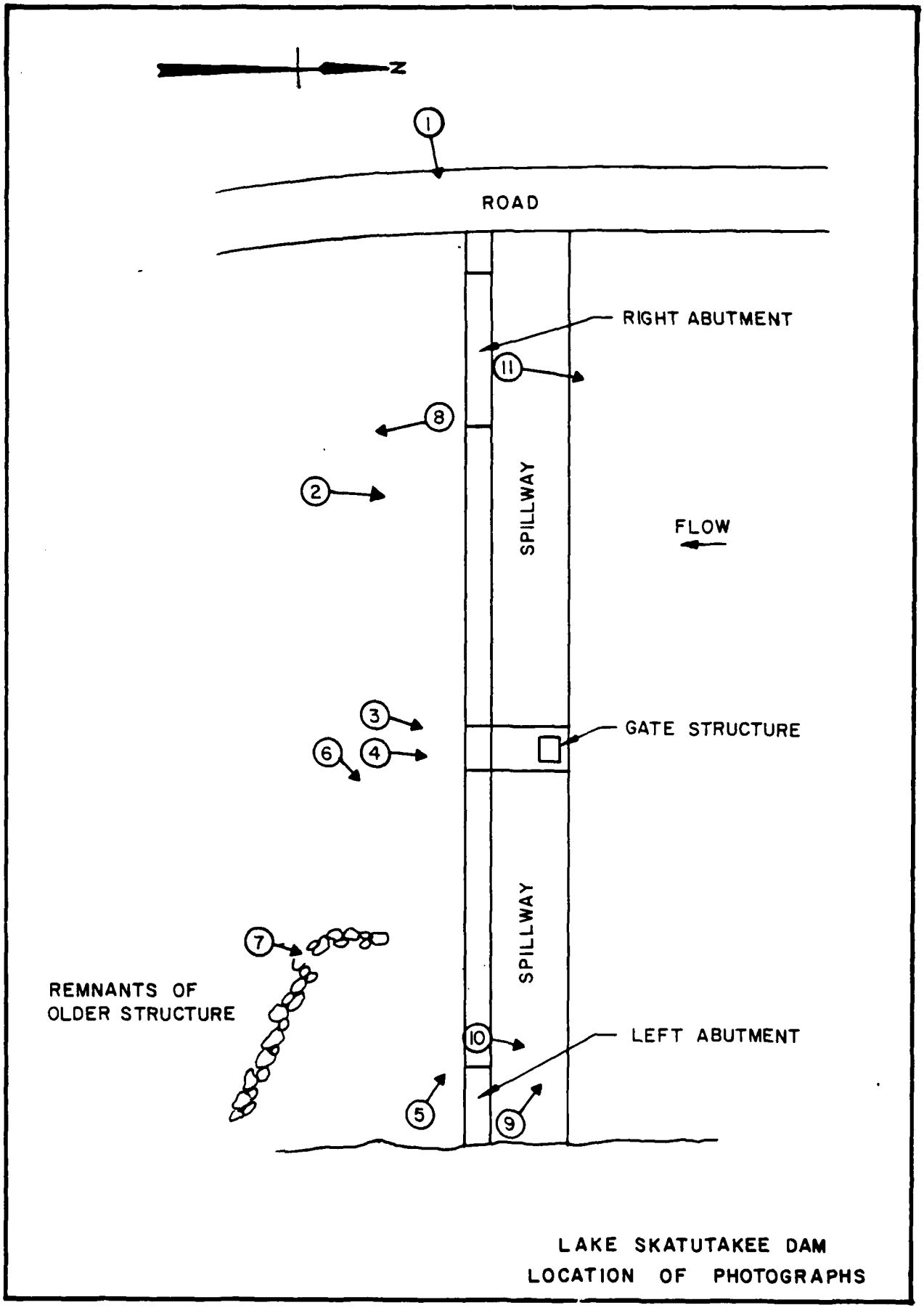
APPENDIX C

PHOTOGRAPHS

APPENDIX C

REPRESENTATIVE PHOTOGRAPHS OF PROJECT

11.	The "Lower Pond" of Lake Skatutakee looking upstream from the right abutment.	3-26A	C·
12.	Lake Skatutakee northeast end near the channel with bridge, looking towards the "Lower Pond" downstream.	3-33A	C·
13.	Bridge over the channel from Lake Skatutakee to the "Lower Pond," looking upstream.	3-29A	C·
14.	Same bridge, looking upstream (west) towards Lake Skatutakee.	3-30A	C·

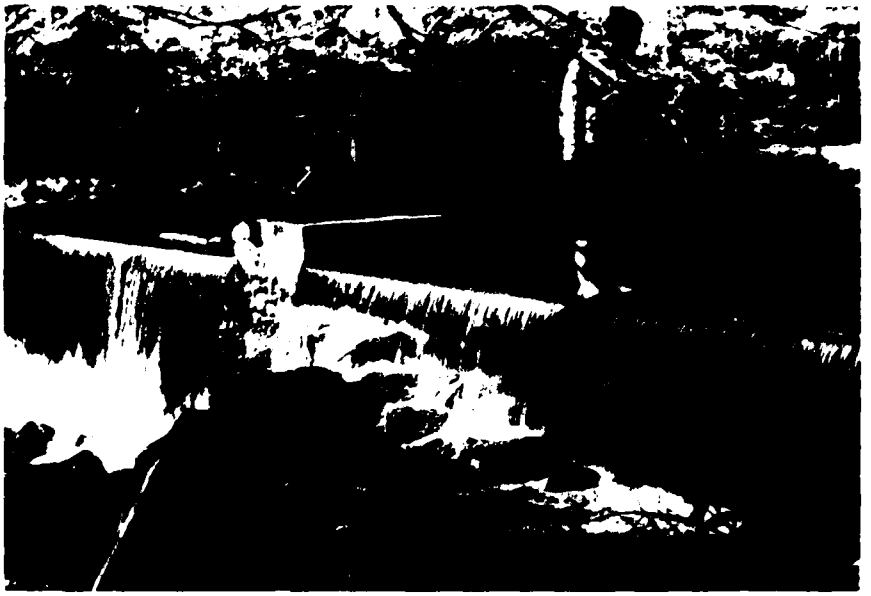

N
1
ROAD
RIGHT ABUTMENT
11
8
2
SPILLWAY
FLOW
3
6
4
GATE STRUCTURE
SPILLWAY
7
REMNANTS OF
OLDER STRUCTURE
10
LEFT ABUTMENT
5
9
LAKE SKATUTAKEE DAM
LOCATION OF PHOTOGRAPHS

1. Overall view from the road at right abutment.

2. Spillway on the right bank of dam.

3. Top part of the gate structure at center of dam.

4. Sluice gate conduit, looking upstream. Gate closed.



5. View of the dam from the left bank.

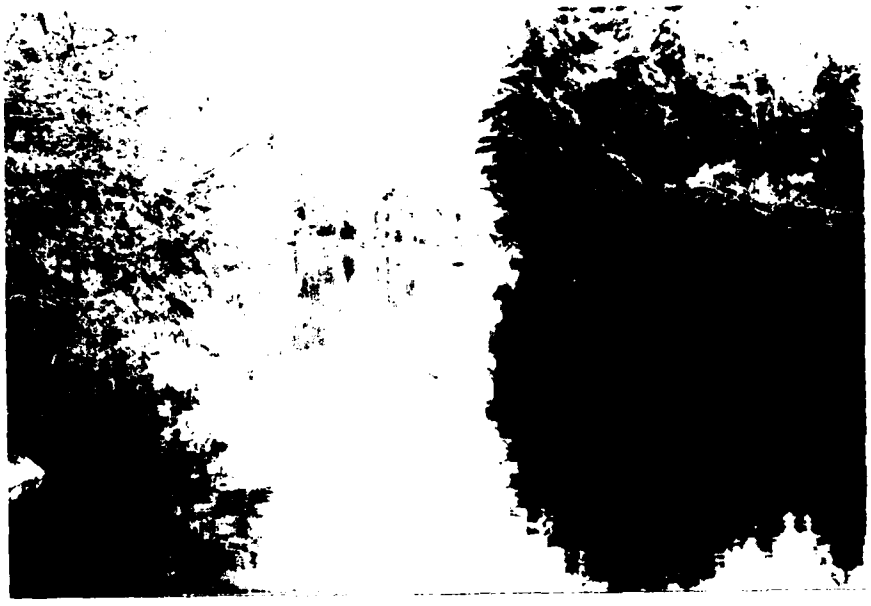
6. The left half of the dam, showing remnants of the structure's lower stream.

7. Debris in the downstream channel near left bank.

8. Downstream channel looking from the right bank near the dam.

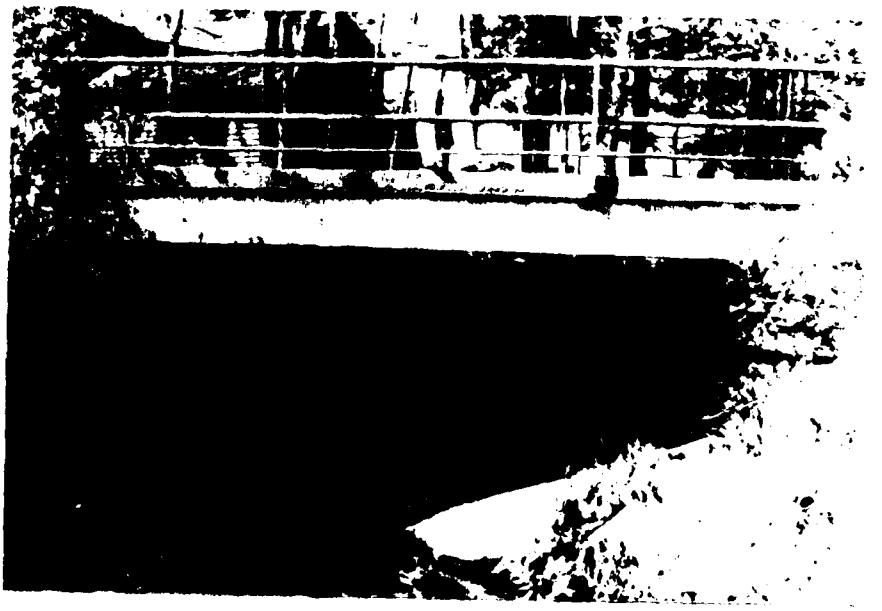
9. Reservoir embankment by the road, on the right bank, looking from the left abutment.

10. Debris near the left abutment.



11. The "Lower Pond" of Lake Skatutakee looking upstream from the right abutment.

12. Lake Skatutakee northeast end near the channel with bridge, looking towards the "Lower Pond" downstream.



13. Bridge over the channel from the Lake Skatutakee to the "Lower Pond," looking upstream.

14. Stone bridge, looking upstream (west) toward Lake Skatutakee.

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

APPENDIX - D

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-006 (11)

FILE NUMBER EN-006

SHEET NUMBER 1

DATE 6/12/72

COMPUTED BY [illegible]

CHECKED BY

SUBJECT NATIONAL DAM INSP. PROGRAM -
LAKE SKATUTAKEE DAM

Total drainage area of Lake Skatutakee = 13.7 square miles

The drainage area of Lake Skatutakee is characterized by rolling topography. Hence, from guide curves furnished by the Army Corps of Engineers, it is found that:

$$\text{Probable Maximum}_{\text{INFLOW}} \text{ Flood Peak} = 1{,}550 \times 13.7$$

$$= 21{,}235.0 \text{ CFS}$$

According to size classification, Lake Skatutakee dam is intermediate.

According to hazard classification, it falls under the category of high hazard dam.

∴ SPILLWAY TEST FLOOD PEAK INFLOW
= 21,235.0 cfs.

FAY SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-601 (11)

FILE NUMBER EN-12
SHEET NUMBER 2 OF
DATE 7-12-1973
COMPUTED BY VSK
CHECKED BY

SUBJECT LITTLE QUITTICUS LAKE DAM

SPILLWAY TEST FLOOD INFLOW HYDROGRAPH
(BASED ON SCS DIMENSIONLESS UNIT HYDROGRAPH).

Max. length of travel = 34,000 ft.
Depth of Impoundment = 700'

∴ Time of Concentration, $t_c = \frac{(34000)^{1.15}}{7700 \times (700)^{0.38}}$ hrs.

$= \frac{1621.30}{7700 \times 12.054}$

$= 1.75$ hrs.

SPILLWAY TEST FLOOD PEAK INFLOW (Q_{P_i})

$= 21,235$ cfs.

FAY SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-016 (11)

FILE NUMBER EN-016

SHEET NUMBER D-E

DATE

COMPUTED BY

CHECKED BY

SUBJECT [illegible]

SPILLWAY TEST FLOOD INFLOW HYDROGRAPH
(BASED ON 6SS DIMENSIONLESS UNIT HYDROGRAPH)

T_c = 1.75 hrs.

Q_p = 21235.0 CFS.

T (hrs)	T/Tc	Q/Qp	Q (CFS)
0.44	0.25	0.05	1062.0
0.88	0.50	0.18	3822.0
1.31	0.75	0.73	15501.0
1.75	1.00	1.00	21235.0
2.19	1.25	0.80	16988.0
2.62	1.50	0.40	8494.0
3.06	1.75	0.25	5309.0
3.50	2.00	0.17	3610.0
11.80	2.75	0.06	1274.0
6.12	3.50	0.02	425.0
7.00	4.00	0.01	212.0

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-001 (U)

FILE NUMBER E11-C.6
SHEET NUMBER 4 OF
DATE 2-12-70
COMPUTED BY LKH
CHECKED BY

SUBJECT [illegible]

[illegible] = 1202

[illegible] = 261.0 acres

a. EL. 1202.0 Storage = [illegible] A.F.

b. EL. 1206.0 Storage = [illegible] "

c. EL. 1204.0 Storage = [illegible] "

d. EL. 1208.0 Storage = 2760.0 "

e. EL. 1206.0 Storage = [illegible] "

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EM-606(11)

FILE NUMBER E-1
SHEET NUMBER 5
DATE 6-11-
COMPUTED BY E
CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM.
COMPOSITE DISCHARGE RATING CURVE

Length of spillway = 98 feet.

Length of structure for gate operation = 7.0 fe

Length of non-overflow section of dam = 20 feet.

∴ Total length of dam = 125 feet.

Spillway crest elevation = 1202.0

Elevation of top of dam = 1203.0

Elevation of gate structure = 1203.25.

Width of adjacent roadway = 24 feet.

Width of shoulders on both sides of the road = 6 feet.

Assume width of spread on left side of dam = 5 feet.

It is assumed that the total effective length of spill = 166.0 feet when the lake water surface elevation exceeds 1205.0

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-001 (11)

FILE NUMBER EN-001
SHEET NUMBER 1 OF
DATE 12-11-1979
COMPUTED BY KEB
CHECKED BY

SUBJECT LOCATUTAKEE DAM
COMPOSITE DISCHARGE RATING
CURVE.

SPILLWAY: $L = 98$ feet ; $C = 3.0$

ELEV. 1202.5 $H = 0.5$ $Q = 104$ cfs.

ELEV. 1202.75 $H = 0.75$ $Q = 191$ cfs

ELEV. 1203.00 $H = 1.00$ $Q = 294.0$ cfs.

SPILLWAY + DAM: $L = 98 + 12 + 8 = 118$ feet.

$C = 3.0$

ELEV. 1203.25 ; $Q = 3 \times (1.25)^{3/2} \times 98 + 3 \times 20 \times (.25)^{3/2}$

$= 3 \times 1.397 \times 98 + 3 \times 20 \times 0.125$

$= 411 + 7.5 = 418.5$

$\simeq 419$ cfs.

SPILLWAY + DAM + GATE STRUCTURE:

ELEV. 1203.5 ; $Q = 3 \times 98 \times (1.5)^{3/2} + 3 \times 20 \times (0.50)^{3/2} + 3 \times 7 \times (.25)^{3/2}$

$= 3 \times 98 \times 1.837 + 60 \times 0.353 + 21 \times 0.125$

$= 540 + 21 + 2.62$

$= 563.62$

$\simeq 564$ cfs.

ELEV. 1205.0; $Q = 3 \times 98 \times (3)^{3/2} + 3 \times 20 \times (2)^{3/2} + 3 \times 7 \times (1.75)^{3/2}$

$= 3 \times 98 \times 5.196 + 60 \times 2.828 + 21 \times 2.315$
$= 1527.624 + 169.68 + 48.615$
$= 1745.919$ cfs
$\simeq 1746.0$ cfs.

SPILLWAY + DAM + GATE STRUCTURE + OVERBANKS.

ELEV. 1206.0; $Q = 3 \times 98 \times (4)^{3/2} + 3 \times 20 \times (3)^{3/2} + 3 \times 7 \times (2.75)^{3/2}$
$+ 26 \times 41 \times (1)^{3/2}$

$= 2352 + 60 \times 5.196 + 21 \times 4.56 + 106.6$
$= 2352 + 311.76 + 95.76 + 106.6$
$= 2866.12$
$\simeq 2866.0$ cfs.

ELEV. 1208; $Q = 3 \times 98 \times (6)^{3/2} + 3 \times 20 \times (5)^{3/2} + 3 \times 7 \times (4.75)^{3/2}$
$+ 2.6 \times 41 \times (3)^{3/2}$

$= 3 \times 98 \times 14.696 + 60 \times 11.180 + 21 \times 10.352$
$+ 106.60 \times 5.196$

$= 4320.6 + 670.8 + 217.392 + 553.894$
$= 5762.686$ cfs.

$\simeq 5763.0$ cfs.

FAY SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-006 (11)

FILE NUMBER EN-006
SHEET NUMBER 5 OF
DATE 10-16-1978
COMPUTED BY VEM
CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM
COMPOSITE DISCHARGE RATING CURVE

ELEV. 1210.0 :

$$Q = 3 \times 98 \times (8)^{3/2} + 3 \times 20 \times (7)^{3/2} + 3 \times 7 \times (6.75)^{3/2} + 2.6 \times 41 \times (5)^{3/2}$$

$$= 3 \times 98 \times 22.627 + 60 \times 18.52 + 21 \times 17.537 + 2.6 \times 41 \times 11.180$$

$$= 6652.33 + 1111.2 + 368.277 + 1191.788$$

$$= 9323.595$$

$$\simeq 9324.0 \text{ cfs (SAY)}$$

ELEV. 1212.0

$$Q = 3 \times 98 \times (10)^{3/2} + 3 \times 20 \times (9)^{3/2} + 21 \times (8.75)^{3/2} + 2.6 \times 41 \times (7)^{3/2}$$

$$= 3 \times 98 \times 31.622 + 60 \times 27 + 21 \times 25.882 + 2.6 \times 41 \times 18.52$$
$$= 4296.868 + 1620 + 543.522 + 1974.232$$
$$= 13434.648$$
$$\simeq 13435.0 \text{ cfs.}$$

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-606(11)

FILE NUMBER EN-01.6
SHEET NUMBER 1 OF
DATE 12-11-1978
COMPUTED BY LRM
CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM
COMPOSITE DISCHARGE RATING CURVE.

ELEV. 1214.0

$$Q = 3 \times 98 \times (12)^{3/2} + 3 \times 20 \times (11)^{3/2} + 21 \times (10.75)^{3/2} + 2.6 \times 41 \times (9)^{3/2}$$

$$= 3 \times 98 \times 41.569 + 3 \times 20 \times 36.482 + 21 \times 35.246 + 2.6 \times 41 \times 27.0$$

$$= 12221.286 + 2188.92 + 740.166 + 2878.2$$

$$= 18028.572$$
$$\simeq 18029.0 \text{ cfs.}$$

$$Q_s = 3 \times 48 \times (11.4)^{3/2}$$

$$= 11,316.0 \text{ cfs.}$$

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-00h (11)

FILE NUMBER EN-016
SHEET NUMBER 10 of E
DATE 12-11-1979
COMPUTED BY W.N.
CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM
COMPOSITE DISCHARGE RATING CURVE

ELEVATION OF SPILLWAY CREST = 1202.0

ELEVATION	Q (CFS)
1202.5	104.0
1202.75	191.0
1203.00	294.0
1203.25	419.0
1203.50	564.0
1205.00	1746.0
1206.00	2866.0
1208.00	5763.0
1210.00	9324.0
1212.00	13435.0
1214.00	18029.0

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-106 (11)

FILE NUMBER EN-106
SHEET NUMBER 4 of F
DATE 10-2-1978
COMPUTED BY EH
CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM
TO DETERMINE PEAK OUTFLOW.

SPILLWAY TEST FLOOD PEAK INFLOW (Q_{IP})

$= 21,235.0$ cfs

TRIAL #1:

Assume inflow volume = 19" of runoff from D.A.

Available surcharge storage upto the top of dam

$$= \frac{270 \times 1.0}{13.7 \times 640} \times 12$$

$= 0.369$ inches.

$$\frac{\text{Lake surcharge storage}}{\text{Inflow runoff volume}} = \frac{0.369}{19}$$

$= 0.019$

Referring to Figure 17-11 in SCS NEH, Section 4

$$\frac{\text{Outflow Peak Rate}}{\text{Inflow Peak Rate}} = 0.98$$

Outflow Peak Rate $= 0.98 \times 21,235$

$= 20,810$ cfs. (1)

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-006(11)

FILE NUMBER EN-006
SHEET NUMBER 6 OF
DATE 12-4-1972
COMPUTED BY VRM
CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM
— DETERMINE PEAK OUTFLOW.

TRIAL #2:

From the composite rating curve, the above outflow peak rate corresponds to ELEV. 1215.40

i.e. Surcharge height above the spillway crest
= 13.4 feet.

∴ Vol. of surcharge storage (STOR$_1$)

$$= \frac{270 \times 13.4}{13.70 \times 640} \times 12$$

= 4.95 inches of runoff from D.A.

∴ Peak outflow $Q_{P_2} = Q_{P_1}\left(1 - \frac{4.95}{19}\right)$

$$= 21,235\,(1 - 0.261)$$

$$= 21,235 \times 0.739$$
$$= 15,692 \text{ cfs} \qquad (2)$$

TRIAL #3:

From the composite rating curve, the above outflow peak rate corresponds to ELEV. 1213.0

i.e. Surcharge height above spillway crest
= 11.0 feet.

∴ Volume of surcharge (storage$_1$) $= \frac{270 \times 11.0}{13.70 \times 640} \times 12$

$= 4.064$ inches of runoff.

∴ Peak outflow $Q_{P_2} = 21,235\left(1 - \frac{4.064}{19}\right)$

$= 21,235\,(1 - 0.2138)$

$= 21,235 \times 0.7862$

$= 16,695.0$ cfs (3)

TRIAL #4:

From the composite rating curve, the above outflow peak rate corresponds to ELEV. 1213.40

i.e. surcharge height above spillway crest = 11.4 ft.

∴ Vol. of surcharge (storage$_2$) $= \frac{270 \times 11.4}{13.70 \times 640} \times 12$

$= 4.212$ inches of runoff.

∴ Peak outflow rate $= 21,235\left(1 - \frac{4.212}{19}\right)$

$= 21,235\,(1 - .2217)$

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-661 (11)

FILE NUMBER EN-11.1
SHEET NUMBER 4 OF
DATE 6-12-1972
COMPUTED BY VRH
CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM.
TO DETERMINE PEAK OUTFLOW

Peak outflow cfs = 21,235 x 0.7783
= 16,527 cfs

Average of $ETOR_1$ and $ETOR_2$ = $\frac{4.064 + 4.212}{2}$

= 4.138 inches.

∴ PEAK OUTFLOW = $21,235 \left(1 - \frac{4.138}{17}\right)$

= 21,235 x (1 − 0.218)
= 21,235 x 0.782

= 16606 cfs.

∴ The corresponding maximum pool ELEV. 1213.40

∴ Maximum surcharge height = 11.40 feet

Dam would be overtopped by 10.40 feet.

At maximum pool elevation 1213.40, the spillway can pass about 68% of PEAK OUTFLOW.

But, the spillway can possibly about 2% of the test flood peak outflow without overtopping the dam. Therefore, the spillway capacity is grossly inadequate.

FAY SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-306 (11)

FILE NUMBER EN-306
SHEET NUMBER 15
DATE 2-12-1972
COMPUTED BY KDM
CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM
ESTIMATION OF OUT-LET DISCHARGE

Cross-sectional area of outlet = 4 × 4.5
= 18.0 SQ. FT.

Invert Elevation of outlet = 1193.0

Assume $C_d = 0.6$

At ELEV. 1202

$$Q_1 = 0.60 \times 18 \times \sqrt{2gh}$$
$$= 0.60 \times 18 \times 8.02 \sqrt{7}$$
$$= 228.5 \text{ cfs}$$
$$\simeq 228.0 \text{ cfs (say)}.$$

At max. pool ELEV. 1213.40

$$Q_2 = 0.60 \times 18 \times 8.02 \sqrt{18.4}$$
$$= 371.54 \text{ cfs}$$
$$\simeq 372.00 \text{ cfs (say)}$$

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-006(11)

FILE NUMBER EN-006

SHEET NUMBER 3

DATE 16-12-1958

COMPUTED BY KDH

CHECKED BY

SUBJECT LAKE SKATUTAKEE DAM

ESTIMATION OF DEPTH OF FLOOD WATERS IN THE VICINITY OF DAMAGE IMPACT AREA DUE TO BREACH IN THE DAM AT RESERVOIR FULL CONDITION.

As explained in section 1.2d, it is not possible to generate downstream dam failure hydrograph in the vicinity of damage impact area, using USGS topo map on which the contours are at 20-feet intervals.

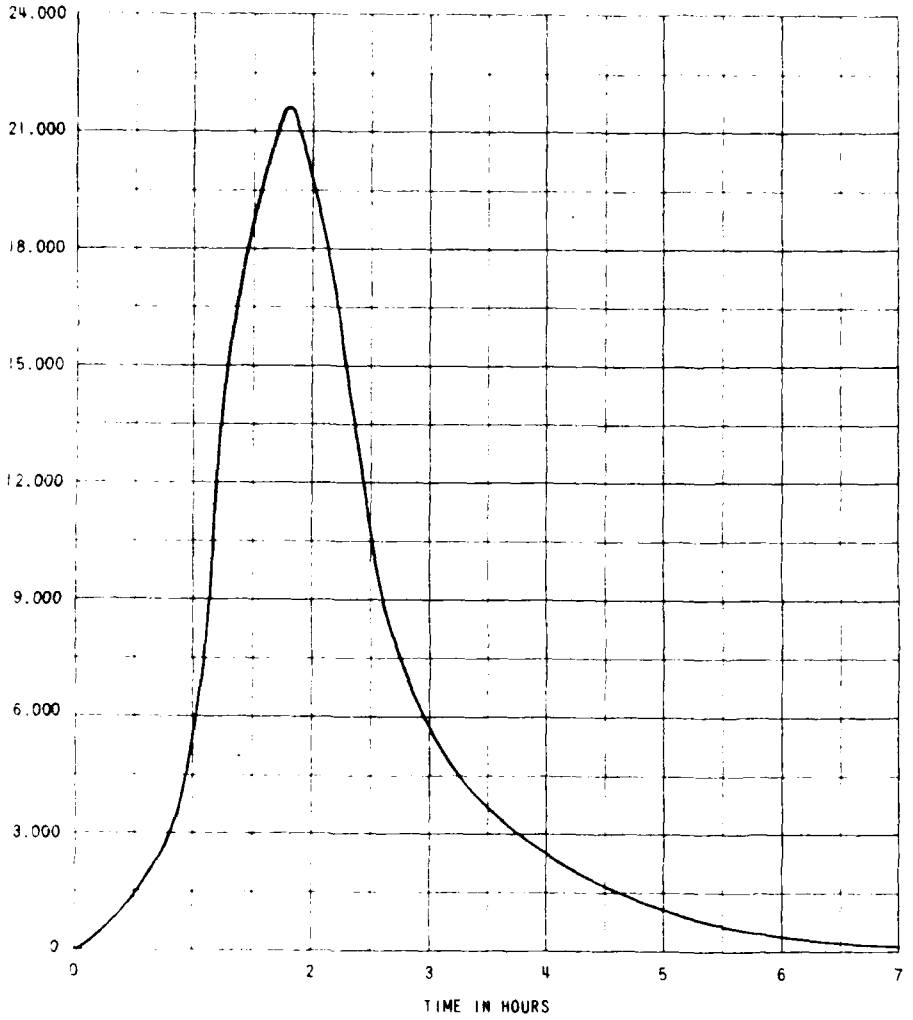
Besides, no other topographic map is available for the area.

From the knowledge of the damage impact area in the vicinity of Eastview village which is at a distance of 1½ miles downstream from the dam, a ball park estimate has been made as follows:

Depth of water above the riverbed at F.R.L
= 1202.0 − 1189.0
= 13.0 feet.

Height of flood wave at damage impact area is estimated to be 9.0 feet.

Width of water spread at damage impact area is approximately indicated on the USGS map included in APPENDIX-D.



SPILLWAY DESIGN FLOOD INFLOW HYDROGRAPH

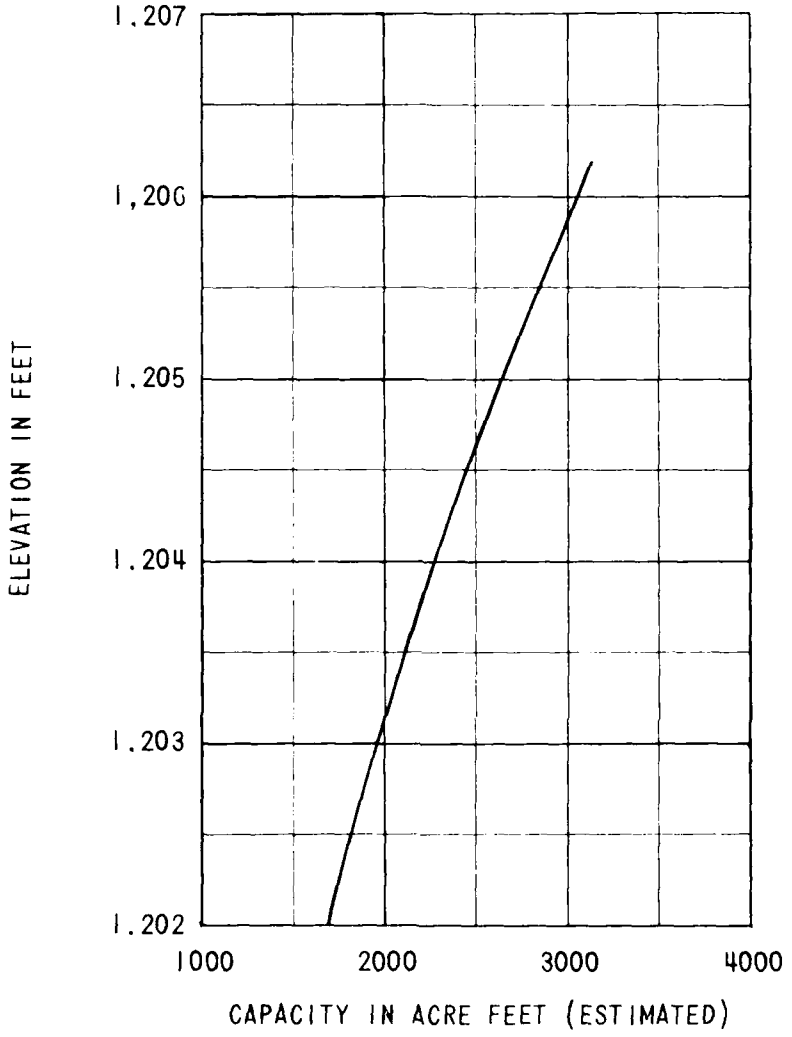
FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LAKE SKATUTAKEE DAM

NUBANUSIT BROOK — NEW HAMPSHIRE

			SCALE AS SHOWN
			DATE AUGUST 1978



STORAGE CAPACITY - ELEVATION CURVE

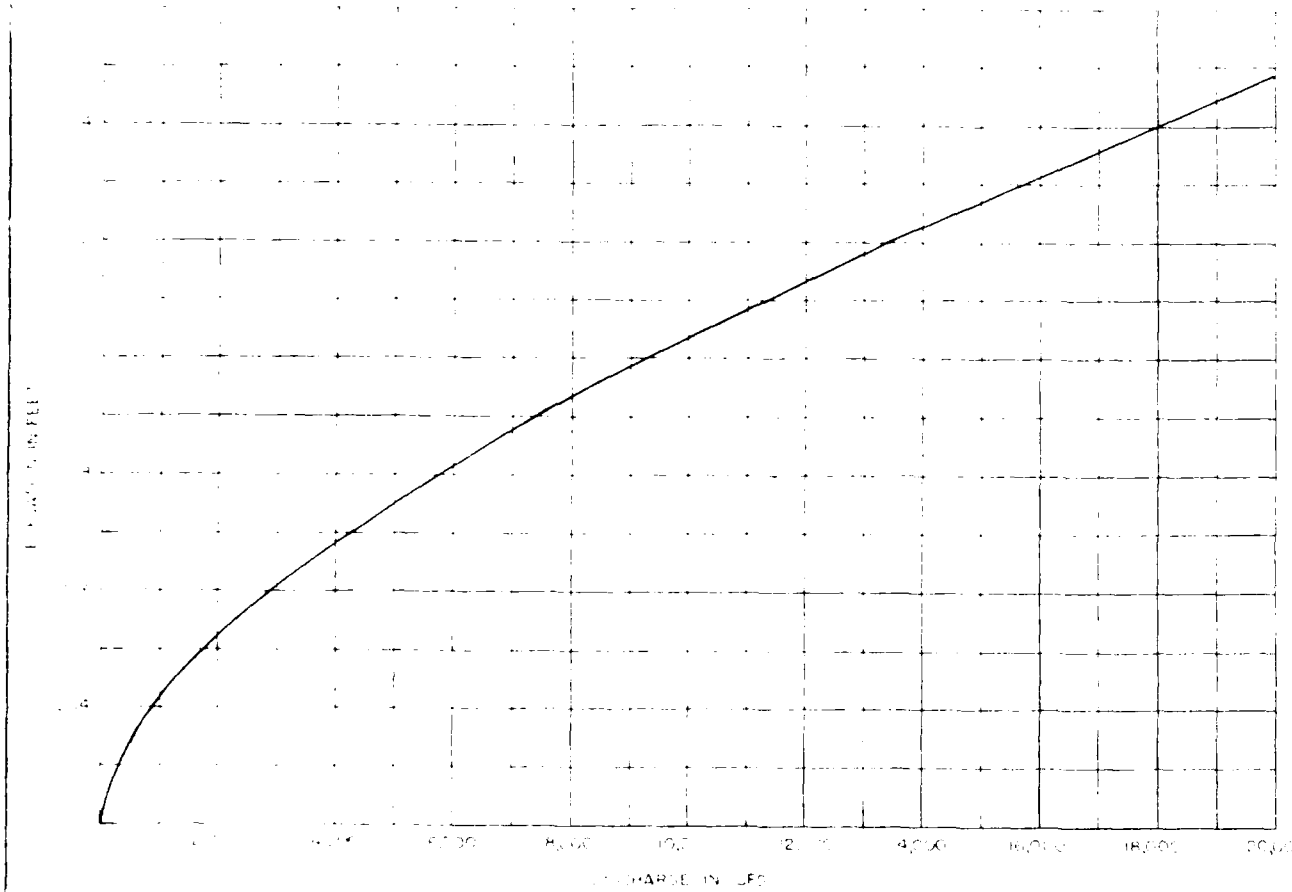
FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS.	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LAKE SKATUTAKEE DAM

NUBANUSIT BROOK — NEW HAMPSHIRE

SCALE	AS SHOWN
DATE	AUGUST, 1978



RATING CURVE FOR SPILLWAY AND DAM

FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS.			U.S. ARMY ENGINEER DIVISION NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

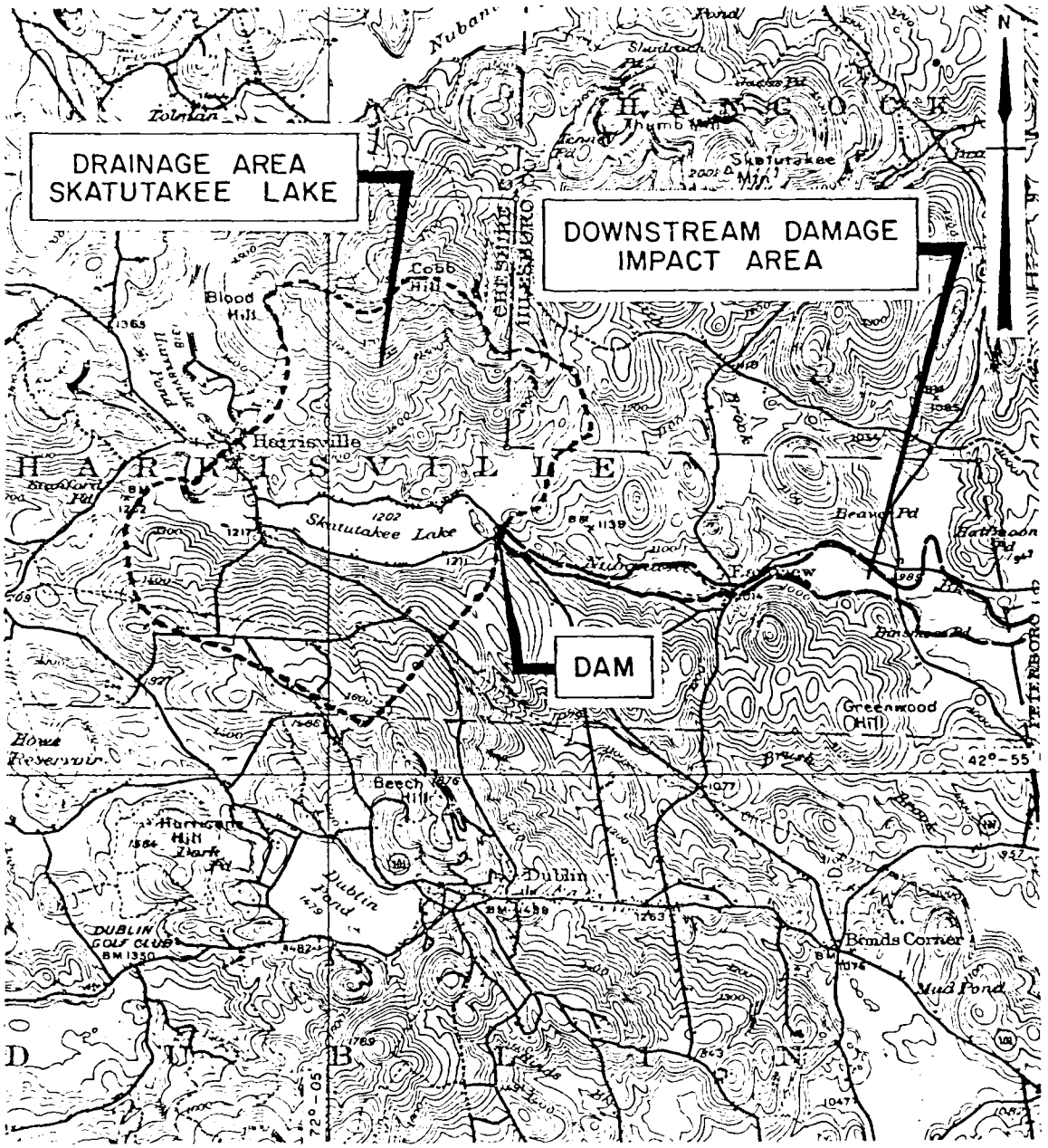
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

LAKE SKATUTAKEE DAM

NUBANUSIT BROOK — NEW HAMPSHIRE

SCALE AS SHOWN

DATE AUGUST 1978



SCALE 1:62500 (ACTUAL)

UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

NEW HAMPSHIRE
MONADNOCK QUADRANGLE
1949
AMS 6569 I-SERIES V 712

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(10) NAME	(15) LATITUDE (NORTH)	(16) LONGITUDE (WEST)	(17) REPORT DATE DAY | MO | YR
NH	66	NED	NH	005	02				LAKE SKATUTAKEE DAM	4256.3	7203.9	15AUG78

(12) POPULAR NAME	(13) NAME OF IMPOUNDMENT
	LAKE SKATUTAKEE

(11) REGION	(18) BASIN	(19) RIVER OR STREAM	(20) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(21) DIST FROM DAM (MI.)	(22) POPULATION
01	08	NUBANUSIT BROOK	EASTVIEW	1	200

(23) TYPE OF DAM	(24) YEAR COMPLETED	(25) PURPOSES	(26) STRUCTURAL HEIGHT (FT.)	(27) HYDRAULIC HEIGHT (FT.)	(28) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(29) NORMAL (ACRE–FT.)	(30) DIST	(31) OWN	(32) FED R	(33) PRV/FED	(34) SCS A	(35) VER/DATE
MACTPG	1937	R	14	13	1950	1680	NED	N	N	N	N	10AUG78

(36) REMARKS

(37) D/S HAS	(38) SPILLWAY CREST LENGTH	(39) SPILLWAY TYPE	(40) SPILLWAY WIDTH (FT.)	(41) MAXIMUM DISCHARGE (FT.)	(42) VOLUME OF DAM (CY)	(43) POWER CAPACITY INSTALLED (MW)	(44) POWER CAPACITY PROPOSED (MW)	(45) NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	125	U	98	245	500											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
LAKE SKATUTAKEE ASSOC		

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NH WATER RES BD

(50) INSPECTION BY	(51) INSPECTION DATE DAY | MO | YR	(52) AUTHORITY FOR INSPECTION
FAY SPOFFORD + THORNDIKE, INC	26MAY78	PL92-367

(53) REMARKS

END

FILMED

8-85

DTIC